Summary of Screening Results for Kuskokwim River Sediment and Water Samples collected June-July, 2013.

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Introduction

This report provides risk screening results and summary for water quality samples collected along the Kuskokwin River in the area of Telida, Alaska in June and July 2013. The objectives of the sampling project are: a) characterize water quality and b) establish baseline for metals in the different areas sampled. This data will be utilized as part of a long term monitoring program in the area in light of potential future developments in the watershed. The sampling effort included water quality readings, surface water and sediment samples at ten locations along the Kuskokwin River watershed.

Sample Screening

To understand if a chemical in the environment poses any threat to human and animal receptors, the EPA has published risk-based benchmarks used for screening environmental samples**.** These benchmarks are not regulatory standards, site-specific cleanup levels, or remediation goals but an efficient tool to identify contaminants of concern when evaluating environmental data from potentially contaminated sites.

What are benchmarks?

A benchmark is a chemical concentration, specific to either water or sediment, above which there is the possibility of harm or risk to the humans or animals in the environment.

Sediment Samples

Sediment samples were screened against EPA freshwater and marine ecological benchmarks for the protection of aquatic species since there are no EPA human health sediment screening values. The maximum concentration detected in sediment for each metal was used in the screening exercise. Any metal concentration exceeding the ecological benchmark was considered a metal of concern (MOC). The MOC classification does not imply severe effect; rather it identifies metals that may cause adverse effect to aquatic life. In addition, since some of these metals have the potential to bioaccumulate, bioconcentrate and/or biomagnify in the aquatic system, there is the likelihood that they could pose risk to aquatic organisms.

- *Bioaccumulation is a process by which chemicals are taken up by a plant or animal either directly from exposure to a contaminated medium (soil, sediment, water) or by eating food containing the chemical;*

- *Bioconcentration – a process by which chemicals are absorbed by an animal or plant to levels higher than the surrounding environment; and*

- *Biomagnification- a process in which chemical levels in plants or animals increase from transfer through trophic transfer or food web (e.g., predators have greater concentrations of a particular chemical than their prey).*

Table 1 (Appendix A), highlights metals that exceed sediment benchmarks for the protection of aquatic life. Also, below are some of the key metals, by location (also see Table 1):

1) High Power Creek Sediment MOCs are: Arsenic, cadmium, copper, nickel, selenium and zinc.

   Basis: All metals exceed both the freshwater and marine benchmarks

2) Telida Village Sediment MOCs are: Arsenic, copper and nickel
   Basis: All metals exceed both the freshwater and marine benchmarks

3) North Fork Sediment MOCs are: Arsenic, copper and nickel
   Basis: All metals exceed both the freshwater and marine benchmarks

4) North Fork Duplicate Sediment MOCs are: Arsenic, copper and nickel
   Basis: All metals exceed both the freshwater and marine benchmarks

Surface Water Samples

Under the Clean Water Act (CWA) and its implementing regulations, States and authorized Tribes are to adopt water quality criteria to protect designated uses (e.g., public water supply, recreational use, industrial use). Section 304(a) of the CWA of 1972 provides guidance to states and tribes for use in developing and adopting water quality standards. Water quality standards published pursuant to EPA's recommended aquatic life and human health criteria do not substitute for the CWA or regulations, nor are they regulations themselves because they do not impose legally binding requirements. States and authorized Tribes have the discretion to adopt, where appropriate, other scientifically defensible water quality standards that differ from these recommendations.

Aquatic Life Criteria

The ambient water quality criterion for aquatic life is the highest concentration of a pollutant or parameter in water that is not expected to pose a significant risk to the majority of species in a given environment.

Human Health Criteria

The human health ambient water quality criterion is the highest concentration of a pollutant in water that is not expected to pose a significant risk to human health.

Surface Water Screening

Surface water samples were screened against EPA National Recommended Ambient Water Quality Criteria (AWQC). The maximum concentration detected in surface water for each metal was used in the exercise. Any metal concentration exceeding the AWQC (protection of aquatic life and/or human health) was considered a metal of concern (MOC). The MOC classification does not imply severe effect; rather it identifies metals that may cause adverse effect to aquatic life and human health. In addition, some of these metals have the potential to move up the food chain; therefore, there is the likelihood that they could pose risk to aquatic life and human health.

Table 2 (Appendix B), highlights metals that exceed AWQCs for the protection of aquatic life and human health. Also, below are some of the key metals, by location (also see Table 2):

1) High Power Creek Surface water MOC: Arsenic

   Basis: Arsenic exceeds the human health AWQC for ingestion of aquatic organism only and ingestion of water and organism.

2) Takotna River Surface Water MOC: Arsenic

   Basis: Arsenic exceeds the human health AWQC for ingestion of aquatic organism only and ingestion of water and organism.

3) Telida Village Surface Water MOCs are: Arsenic, cadmium, chromium, copper, lead, nickel and zinc.

   Basis: a) Arsenic exceeds the human health AWQC for ingestion of aquatic organism only and ingestion of water and organism;
   b) Cadmium, chromium, copper, nickel and zinc all exceed the freshwater chronic criteria for aquatic life;
   c) Copper, lead, nickel and zinc all exceed the saltwater chronic criteria for aquatic life.

4) North Fork Surface water MOCs are: Arsenic, cadmium, chromium, lead and zinc
   Basis: a) Arsenic exceeds the human health AWQC for ingestion of aquatic organism only and ingestion of water and organism;
   b) Cadmium, chromium and lead all exceed the freshwater chronic criteria for aquatic life;
   c) Copper, lead and zinc all exceed the saltwater chronic criteria for aquatic life.

5) Nixon Fork Surface water MOC: Arsenic
   Basis: Arsenic exceeds the human health AWQC for ingestion of aquatic organism.

6) East Fork Surface water MOCs are: Arsenic, cadmium, chromium, lead and nickel

   Basis: a) Arsenic exceeds the human health AWQC for ingestion of aquatic organism only and ingestion of water and organism;

   b) Cadmium, chromium and lead all exceed the freshwater chronic criteria for aquatic life;
   c) Nickel exceeds the saltwater chronic criteria for aquatic life.

7) Big River Surface water MOCs are: Arsenic, chromium, copper, lead, nickel and selenium.
   Basis: a) Arsenic exceeds the human health AWQC for ingestion of aquatic organism only and ingestion of water and organism;
   b) Chromium, copper, lead, nickel and selenium all exceed the freshwater chronic criteria for aquatic life;
   c) Lead, nickel and selenium all exceed the saltwater chronic criteria for aquatic life.

8) Tonzana River Surface water MOCs are: Arsenic, copper, lead and nickel.
   Basis: a) Arsenic exceeds the human health AWQC for ingestion of aquatic organism only and ingestion of water and organism;
   b) Lead exceeds the freshwater chronic criteria for aquatic life;
   c) Copper and nickel both exceed the saltwater chronic criteria for aquatic life.

9) Nikolai Village Surface water MOCs are: Arsenic, chromium, copper, lead and nickel
   Basis: a) Arsenic exceeds the human health AWQC for ingestion of aquatic organism only and ingestion of water and organism;
   b) Chromium and lead both exceed the freshwater chronic criteria for aquatic life;
   c) Copper, lead and nickel all exceed the saltwater chronic criteria for aquatic life.

10) McGrath Village Surface water MOCs are: Arsenic, cadmium, chromium, copper, lead, mercury and nickel
   Basis: a) Arsenic exceeds the human health AWQC for ingestion of aquatic organism only and ingestion of water and organism;
   b) Cadmium, chromium, lead and mercury all exceed the freshwater chronic criteria for aquatic life;
   c) Copper, lead, mercury and nickel all exceed the saltwater chronic criteria for aquatic life.

Conclusions

Sediment

At High Power Creek: the levels of arsenic, cadmium, copper, nickel, selenium and zinc, could pose risk to sediment dwelling organisms which without doubt affect benthic dwelling organisms that depend on them.

At Telida Village and North Fork locations: the levels of arsenic, copper, nickel, selenium and zinc, could pose risk to sediment dwelling organisms which without doubt affect benthic dwelling organisms that depend on them.

Surface Water

Screening results show that the level of metals in surface water could pose risk to aquatic life and human health at the following locations:

Sample Locations	Metal(s) of Concern (MOCs)	Receptor(s)
High Power Creek	Arsenic	Human
Takotna River	Arsenic	Human
Telida Village	Arsenic, cadmium, chromium, copper, lead, nickel and zinc.	Human and Aquatic organisms
North Fork	Arsenic, cadmium, chromium, lead and zinc.	Human and Aquatic organisms
Nixon Fork	Arsenic	Human
East Fork	Arsenic, cadmium, chromium, lead and nickel.	Human and Aquatic organisms
Big River	Arsenic, chromium, copper, lead, nickel and selenium.	Human and Aquatic organisms
Tonzana River	Arsenic, copper, lead and nickel.	Human and Aquatic organisms
Nikolai Village	Arsenic, chromium, copper, lead and nickel.	Human and Aquatic organisms
McGrath Village	Arsenic, cadmium, chromium, copper, lead, mercury and nickel.	Human and Aquatic organisms

Limitations

The outcomes highlighted in the screening exercise are based on available EPA benchmark values. EPA is constantly updating this database when new toxicity data becomes available; therefore, the published benchmark values should not be regarded as regulatory standards, site-specific cleanup levels, or remediation goals. To conclude these metals will actually pose risk to aquatic life and human health, a definitive analysis will be needed which will take into account other parameters such as cancer potency, toxicity and bioaccumulation for each metal. Therefore, the screening phase using benchmark values should be viewed as the first step in the process.

References

EPA (2001). Water Quality Criterion for the Protection of Human Health: Methylmercury [EPA-823-R-01-001 (January 2001)]. Note: The 0.3 mg methylmercury/kg fish is the concentration in fish tissue that should not be exceeded based on a total consumption of 0.0175 kg fish/day.

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